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Adaptive Management for Ecosystem Restoration: Analysis and Issues for Congress

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Summary

Adaptive management is the process of incorporating new scientific and programmatic information into the implementation of a project or plan to ensure that the goals of the activity are being reached efficiently. It promotes flexible decision-making to modify existing activities or create new activities if new circumstances arise (e.g., new scientific information) or if projects are not meeting their goals.

The complex and dynamic nature of ecosystems make their restoration and management amenable to an adaptive management approach, and the concept is being implemented at scales that include entire regions or river basins. Adaptive management has been used to guide several major ecosystem restoration efforts with involvement by the federal government, including those on the Colorado and Platte rivers. Some of these adaptive management efforts have been specifically authorized by Congress, whereas other efforts have been formulated by agencies. Adaptive management has also been proposed as a guiding principle for several new and ongoing major restoration efforts, including those in the Chesapeake Bay and Lake Tahoe.

The concept of adaptive management is straightforward, but its implementation can be difficult. A preliminary review of federal adaptive management efforts related to ecosystem restoration projects suggests that governance structures, management protocol and other factors vary widely. Additionally, the scope and timing of efforts employing the term "adaptive management" seems to vary among these projects. Where adaptive management has been implemented, it has encountered challenges. While adaptive management theoretically uses the best available science and monitoring to guide a project or program towards its stated goals, in practice the process can be affected by a number of outside factors.

As the number of federal adaptive management efforts grows, Congress may revisit its role in shaping adaptive management programs in legislation. Some argue that Congress should do more to provide specific direction for major adaptive management initiatives in order to make adaptive management more consistent among these efforts. Others contend that Congress should allow federal agencies or restoration governing bodies to shape their own adaptive management programs, thus providing them with flexibility to match their program to their restoration needs. In addressing adaptive management, Congress may face decisions regarding the implementation guidelines and authorizations it provides these efforts, funds to establish and carry out these programs, and oversight issues.

This report provides an introduction to the concept of adaptive management. It focuses on the application of this concept to large, freshwater aquatic ecosystem restoration projects with multiple stakeholders. A summary of the benefits and drawbacks of adaptive management for these projects is provided, along with analysis of potential issues associated with various governance models for these efforts. The potential role for Congress in addressing adaptive management is also discussed. As an appendix, the report summarizes the structure and implementation of federal adaptive management efforts to date five ecosystems: Glen Canyon/Colorado River, Platte River, Lower Colorado River, Missouri River, and Florida Everglades.

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Introduction

Adaptive management is the process of incorporating new scientific and programmatic information into the implementation of a project or plan to ensure that the goals of the activity are being reached efficiently. Adaptive management promotes flexible decision-making to modify existing activities or create new activities if existing programs are not meeting set goals, or if new circumstances arise (e.g., new scientific information). The federal government has incorporated the concept of adaptive management into the management of certain natural resources, particularly in cases where scientific information is incomplete and uncertainty exists.

The concept of adaptive management has been widely endorsed by scientists, land managers, and academic observers. Advocates argue that traditional management can be improved by a paradigm that incorporates knowledge based on experimentation and monitoring during ongoing project operations. While adaptive management is widely accepted to be a promising management tool, its implementation has also been criticized. In particular, some have faulted the ability of adaptive management to stimulate meaningful change in programs or projects. According to some, results from adaptive management experiments are difficult to incorporate into programs that are constrained by pre-existing requirements or laws. Others contend that politics can also effect the implementation of adaptive management recommendations. The perceived ineffectiveness of adaptive management generally centers more on its implementation as opposed to its conceptual merits.

Congressional interest in adaptive management has often related to its ability to guide federal efforts to restore large-scale freshwater ecosystems (e.g., wetlands). In prior Congresses, adaptive management has been proposed as a guiding principle for some large-scale ecosystem restoration efforts, including the Everglades, Chesapeake Bay, and Lake Tahoe.[1] Implementation of ecosystem restoration initiatives often centers around initial uncertainties which may be understood and incorporated into restoration efforts over time. Rather than authorizing only initial actions or projects to achieve restoration, Congress has also authorized adaptive management programs to guide and/or complement restoration. These programs have generally been intended to improve monitoring and research to support restoration efforts and provide flexibility for management decisions over time.

Previous experience with adaptive management can inform Congress both in the authorization of new adaptive management efforts and in providing funding and oversight of ongoing efforts. Some have argued that shortcomings in early adaptive management efforts provide lessons learned that could be incorporated into ongoing and future efforts. This report provides general background on adaptive management, including its benefits and drawbacks. It focuses on the application of adaptive management to ecosystem restoration, with a focus on federal efforts to restore freshwater ecosystems. It provides an analysis of adaptive management's usage to date, including the strengths and weaknesses of the concept as they have been observed in practice. It concludes by providing information and preliminary issues for Congress to consider when providing authorization, funding, and oversight of these efforts.

[1] Adaptive management for Everglades restoration was authorized in WRDA 2000. More recently, adaptive management was proposed in authorizing legislation for the restoration of Chesapeake Bay and Lake Tahoe in the 111th Congress.

Background: Concept of Adaptive Management

The concept of adaptive management was applied to natural resource management in the early 1970s to help managers take action on conservation issues in the face of uncertainty and when unforeseen conditions or changes in managed ecosystems appeared.[2] Since then, the application of adaptive management has evolved into several forms, depending on the objectives and goals of the initiative or project it accompanies.

Adaptive management also has been characterized as being either *passive* or *active*. According to one author, *passive adaptive management* focuses on a "best apparent management option" at each key decision point for restoring an ecosystem.[3] Generally speaking, passive adaptive management efforts "use the information available to choose good management or restoration options at the start, but they also specify future decision points where feedback and new information are analyzed so that the choice of subsequent restoration actions is based on the total information available at each decision point."[4] By contrast, *active adaptive management* experimentally tests multiple hypotheses and explores a range of options during all phases of implementation to select the best path towards achieving objectives.[5] Active adaptive management relies on monitoring and incorporating results from experiments into models or activities that comprise the restoration effort. Active adaptive management is more costly than passive adaptive management, but it can also yield more information about the ecosystem and its properties.

The implementation of adaptive management has trade-offs. From a policy perspective, the built-in flexibility of adaptive management may be key to solving complex technical problems and changing restoration strategies that are not achieving their goals. Further, some contend that having an adaptive management program may justify the initiation of restoration activities when scientific uncertainty exists. Additionally, adaptive management may provide a forum to engage stakeholder groups and allow for them to provide input into decisions so that the effects adaptive management has on stakeholders are considered. On the other hand, adaptive management can create uncertainty among stakeholders who rely on ecosystem services for their livelihood. Flexible implementation of a restoration initiative can create uncertainty about outcomes and consistency of restoration projects. A more detailed discussion of the benefits and drawbacks of adaptive management is provided later in this report (see "Analysis and Lessons Learned").

Generalized Model for Implementing Adaptive Management

The implementation of adaptive management in ecosystem restoration initiatives can be a complex process, and there is no general consensus on one standard model of adaptive management. However, there are certain elements that are common to many adaptive management efforts. This section provides a general framework that applies to many adaptive management efforts. While it is representative of many adaptive management programs, it does not reflect the subtle or distinct variations among specific programs. Cases studies detailing individual programs are provided in the **Appendix**.

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[2] National Research Council, Panel on Adaptive Management for Resource Stewardship, *Adaptive Management for Water Resources Project Planning* (Washington: National Academies Press, 2004).

[3] J. L. Anderson et al., "Watershed Restoration—Adaptive Decision Making in the Face of Uncertainty," in Robert C. Wissmar, Peter A. Bisson, and Marcus Duke, eds., *Strategies for Restoring River Ecosystems: Sources of Variability and Uncertainty in Natural and Managed Systems* (Bethesda, MD: American Fisheries Society, 2003), p. 206.

[4] Anderson, p. 205.

[5] Anderson, pp. 206-207.

There are several components that generally make up an adaptive management program, including:

- **Objectives for restoration**. A program or project needs targets or goals to be adaptively managed. For some initiatives, this may simply be a broad desired outcome, while others may utilize quantitative goals or objectives set for intervals (e.g., two-year intervals) or as a final objective.
- **Model(s) of the system being managed.** One or more models may offer insight into fundamental processes. These models may in turn be informed by additional monitoring or experimentation and inform project or management regimes (see below).
- **Scientific experimentation and monitoring**. Experiments test a range of approaches to achieving goals periodically during the implementation of the program or project. Monitoring is used to measure the effectiveness of individual projects as well as overall progress toward achieving goals.
- **Management options.** A range of management options that achieve or contribute to achieving objectives is necessary to conduct adaptive management. These options may be complimentary or in competition with one another, and provide an outlet for experimentation and monitoring.
- **Stakeholder input.** Many adaptive management programs incorporate some level of stakeholder input into their processes. For example, stakeholders can serve on committees that identify projects and programs that are to be adaptively managed and on committees that evaluate the results of adaptive management and make recommendations to decision-makers.
- **Mechanism to incorporate change.** Once adaptive management has produced results or preliminary recommendations, a policy or mechanism for implementing changes is necessary. This can be in several forms, including unilateral decision-making, committee votes, or authorizing legislation.

Federal Agency Definitions and Guidance

In 2004, the National Research Council (NRC) of the National Academies of Science examined adaptive management in the context of U.S. Army Corps of Engineers (Corps) management of water resources.[6] The study found multiple views and definitions of adaptive management being applied to agency projects throughout the federal government.[7] This report noted that some agencies have made formal efforts to adopt definitions of adaptive management in applied contexts and to issue related guidance.[8] However, there is no statutory definition of adaptive

[6] National Research Council, Panel on Adaptive Management for Resource Stewardship, *Adaptive Management for Water Resources Project Planning* (Washington: National Academies Press, 2004).

[7] NRC, p. 2. For another NRC study that provides an overview of adaptive management, see National Research Council, Committee on Grand Canyon Monitoring and Research, *Downstream: Adaptive Management of Glen Canyon Dam and the Colorado River System* (Washington: National Academy Press, 1999), pp. 52-54.

[8] Federal agencies are not the only authors of relevant adaptive management guidance. For example, the Environmental Protection Agency links to a portion of a document that was developed by the Biodiversity Support Program (BSP)—a consortium of World Wildlife Fund, The Nature Conservancy, and World Resources Institute—which was funded by the United States Agency for International Development (USAID). See Nick Salafsky, Richard Margoluis, and Kent Redford, *Adaptive Management: A Tool for Conservation Practitioners* (Washington: Biodiversity Support Program, 2001), pp. 32-63, at http://water.epa.gov/lawsregs/guidance/wetlands/upload/2004_11_17_wetlands_MitigationActionPlan_performance_AdaptiveManagementSteps.pdf. For the full BSP

management, and research by CRS indicates that the application of internal agency definitions of adaptive management varies widely at the project level. The following section provides a summary of the relevant guidance and definition by agencies and other coordinating entities within the Federal Government.

U.S. Department of the Interior (DOI)

The U.S. Department of the Interior (DOI) *Technical Guide* provides guidance for implementing adaptive management for all DOI agencies.[9] DOI defined adaptive management according to the executive summary of the 2004 NRC study.

> Adaptive management [is a decision process that] promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a 'trial and error' process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders.[10]

The *Technical Guide* provides information on what adaptive management is, when it should be used, how it should be implemented, when it might be considered successful, and other topics. It also provides a problem-scoping key for adaptive management, with nine yes-or-no questions and related guidance intended to help determine whether adaptive management is an appropriate approach under particular circumstances.[11] For example, if stakeholders cannot be engaged, the guide advises that adaptive management is unlikely to be effective; and if management objectives cannot be stated explicitly, the guide advises that adaptive management is not possible. The guide also provides a sequence of activities to implement adaptive management. This sequence includes:

- Assessing the problem
- Designing the adaptive management framework (e.g., either passive or active adaptive management)
- Implementing the program
- Monitoring the results of the program and gauging the progress of projects towards achieving their goals

document, see http://www.rmportal.net/library/content/tools/biodiversity-conservation-tools/putting-conservation-in-context-cd/adaptive-management-resources/5-5-a.pdf.

[9] Byron K. Williams, Robert C. Szaro, and Carl D. Shapiro, *Adaptive Management: The U.S. Department of the Interior Technical Guide* (Washington: U.S. Department of the Interior, Adaptive Management Working Group, 2007), at http://www.doi.gov/initiatives/AdaptiveManagement/documents.html; and http://www.doi.gov/initiatives/AdaptiveManagement/index.html.

[10] See Byron K. Williams, Robert C. Szaro, and Carl D. Shapiro, *Adaptive Management: The U.S. Department of the Interior Technical Guide* (Washington: U.S. Department of the Interior, Adaptive Management Working Group, 2007), p. 4. The *Technical Guide* adapted this operational definition from National Research Council, Panel on Adaptive Management for Resource Stewardship, *Adaptive Management for Water Resources Project Planning* (Washington: National Academies Press, 2004), pp. 1-2. Hereafter referred to as "2004 NRC Report".

[11] Williams, p. vi.

- Evaluating the results of the monitoring and determining if changes are warranted
- Adjusting the program or project with the recommended changes[12]

Multi-agency Definition

In 2000, multiple federal agencies adopted a unified federal policy for a "watershed approach" to federal land and resource management.[13] The policy was "intended to accelerate federal progress towards achieving the goals of the Clean Water Act."[14] The unified policy included a nonbinding definition of adaptive management.

> Adaptive management: A type of natural resources management in which decisions are made as part of an ongoing science-based process. Adaptive management involves testing, monitoring, and evaluating applied strategies, and incorporating new knowledge into management approaches that are based on scientific findings and the needs of society. Results are used to modify management policy, strategies, and practices.[15]

The multi-agency policy did not articulate specific adaptive management guidance for agencies, but did indicate that the promulgating agencies "will improve watershed conditions through restoration and adaptive management," working with several kinds of stakeholders.[16] The agencies also "will use scientific information from research and management experience in designing and implementing watershed planning and management programs, and setting management goals (e.g., desired conditions)."

A variation on this definition was included in legislation that passed the House on September 30, 2009. This legislation would have required that the Administrator of the Environmental Protection Agency (EPA) develop an adaptive management plan for the Chesapeake Bay watershed.[17] This bill was not enacted into law.

CEQ Water Resource Project Planning Standards

In 2009, the White House Council on Environmental Quality (CEQ) proposed to incorporate an adaptive management paradigm into the "Principles and Guidelines" for water resource projects for the Corps and other federal agencies.[18] In its proposed revision to the Draft National Objectives, Principles, and Standards for Water and Related Resources Implementation Studies,

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[12] Williams, p. 5.

[13] U.S. Department of Agriculture, U.S. Department of Commerce, U.S. Department of Defense, U.S. Department of Energy, U.S. Department of the Interior, U.S. Environmental Protection Agency, Tennessee Valley Authority, and U.S. Army Corps of Engineers, "Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management," notice of final policy, 65 *Federal Register* 62566 (October 18, 2000), at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2000_register&docid=00-26566-filed.pdf.

[14] USDA et al., p. 62569.

[15] USDA et al., p. 62571. As another example, a definition for adaptive management was provided in an applied context in a final rule governing compensatory mitigation for losses of aquatic resources for activities authorized by permits issued by the Department of the Army. See U.S. Department of Defense, Department of the Army, Corps of Engineers, and Environmental Protection Agency, "Compensatory Mitigation for Losses of Aquatic Resources," 73 *Federal Register* 19594, at 19688 (April 10, 2008), at http://water.epa.gov/lawsregs/guidance/wetlands/upload/wetlands_mitigation_final_rule_4_10_08.pdf.

[16] USDA et al., p. 62570.

[17] House-passed H.R. 1053 (111th Congress), Sections 3 and 5(1).

[18] Congress directed the Corps to revise the Principles and Guidelines for Water Resources Planning in Section 2031 of WRDA 2007 (P.L. 110-114).

CEQ makes several references to adaptive management.[19] Among other things, CEQ proposes the use of adaptive management in water resources projects and would require that adaptive management be evaluated and incorporated into project alternatives when it helps to further avoid and minimize adverse impacts.[20] However, a formal definition of adaptive management is not specified in the proposed guidelines, and details on how adaptive management should be implemented or governed are not specified.

Other Agencies

Projects and programs directed by other agencies also incorporate various forms of adaptive management. For instance, the U.S. Forest Service uses a form of adaptive management in its Northwest Forest Plan, which was adopted in 1994.[21] In the Northwest Forest Plan, the Forest Service defines adaptive management:

> Adaptive management is a continuing process of action-based planning, monitoring, researching, evaluating, and adjusting with the objective of improving the implementation and achieving the goals of these standards and guidelines.

The Northwest Forest Plan uses the concept in the form of "Adaptive Management Areas," landscape units designated to encourage the development and testing of technical and social approaches to achieving desired ecological, economic, and other objectives. In this case, the objective of adaptive management efforts is to learn how to manage an ecosystem base in terms of a variety of challenges and in a manner consistent with applicable laws.

The U.S. Army Corps of Engineers currently incorporates adaptive management in several of its major ecosystem restoration initiatives. To date, the Corps has not identified a uniform definition for adaptive management that is consistent across all water resource projects. Examples of the processes from the Missouri River and Everglades are provided below in a description of case studies that incorporate adaptive management.

The Environmental Protection Agency (EPA) also provides adaptive management guidance for states, communities, and tribes.[22] In the guide for states, for example, EPA places adaptive management as the fifth step within a five-step "watershed analysis and management" process.[23] As the fifth step, adaptive management itself is described as constituting four steps:

- Develop adaptive management plan
- Monitor
- Evaluate monitoring results

[19] The draft standards were published in December 2009 and were recently reviewed by the National Research Council. See http://www.nap.edu/catalog.php?record_id=13071.

[20] White House Council on Environmental Quality, *Proposed National Objectives, Principles, and Standards for Water and Related Resources Implementation Studies*, Washington, DC, December 3, 2009, p. 10, http://www.whitehouse.gov/sites/default/files/microsites/091203-ceq-revised-principles-guidelines-water-resources.pdf.

[21] The Northwest Forest Plan is an integrated, comprehensive design for ecosystem management, intergovernmental and public collaboration, and rural community economic assistance for federal forests in the Northwestern U.S.

[22] See U.S. Environmental Protection Agency, *Watershed Analysis and Management (WAM) Guide for States and Communities*, EPA 841-B-03-007, 2003, at http://water.epa.gov/learn/training/wacademy/wam2003_index.cfm; and Pacific Watershed Institute, *Watershed Analysis and Management (WAM) Guide for Tribes*, EPA 841-B-00-008 (Seattle, WA: Pacific Watershed Institute, 2000), at http://water.epa.gov/learn/training/wacademy/its.cfm.

[23] The five steps include "scoping", "watershed assessment", "synthesis", "management solutions", and adaptive management. See EPA WAM Guide, p. 19.

- Adjust watershed management plan[24]

Adaptive Management and Ecosystem Restoration

As previously mentioned, adaptive management is currently being implemented for a range of activities related to the management of natural resources. For example, adaptive management is being implemented in national oceans policy (including the management of national marine sanctuaries), in conservation efforts to improve species, and to restore large aquatic ecosystems in freshwater habitats. Some also contend that adaptive management can also be used to improve our understanding of and capacity to respond to climate change. While adaptive management is an important concept for all of these activities, this remainder of this report focuses on the application of the concept to large-scale ecosystem restoration (referred to as "ecosystem restoration" in this report). Large-scale ecosystem restoration is noted for its complexity, and has recently garnered increased attention from Congress. It often incorporates scientific, managerial, cultural, and political factors. Some argue that the complex and dynamic nature of ecosystems make their restoration and management amenable to an adaptive management approach, while others argue that these same characteristics make application of the concept more difficult.

Analysis and Lessons Learned

Observers note both benefits and difficulties resulting from federal efforts to implement adaptive management in a natural resource management context. These observations demonstrate some of the broad strengths and weaknesses of adaptive management that may be of use when contemplating the application of adaptive management to a specific management regime.

Potential Benefits of Implementing Adaptive Management

Adaptive management is being used in ecosystem restoration initiatives to address the uncertainties associated with the complex and integrated nature of ecosystems and their restoration. The concept provides managers with a process to experiment and test alternatives for restoring an ecosystem during the implementation of a restoration initiative. Ideally, adaptive management leads to robust decisions, effective designs for restoration projects, efficient investments, and a quicker achievement of goals.[25]

Several potential benefits of adaptive management have been widely noted:

- **Initiating restoration efforts when scientific uncertainty exists.** Adaptive management can commence with the early stages of a restoration initiative when scientific and programmatic uncertainties about the ecosystem and restoration process exist. Some policymakers may be reluctant to endorse a restoration initiative if there is uncertainty about how effective restoration projects will be or if there is uncertainty about conditions and processes associated with the ecosystem and species. The flexibility of adaptive management may address some of these concerns.
- **Potential to deal with changing circumstances over large time periods.** Some restoration initiatives have planned durations extending over significant time

[24] EPA WAM Guide, p. 85.

[25] Donald F. Boesch, et. al. The Future of Water Resources Adaptive Management: Challenges and Overcoming Them, *Water Resources Impact*, May 2006, p. 21.

horizons extending out to 50 years or more in the future. During these periods, significant unforeseen shifts in the ecosystem can occur due to changing climatic conditions, species composition, and habitat alteration. Adaptive management can provide a formal process for addressing these uncertainties and building flexibility into the restoration plan over time.

- **Creation of formal monitoring networks and processes.** While traditional management frameworks often require limited (or no) monitoring networks, adaptive management requires a monitoring program to track the progress of restoration. This monitoring can help provide consistent, basic information about an ecosystem over time that would not have been noted otherwise.
- **Increasing stakeholder buy-in.** If the adaptive management process has an avenue for formal stakeholder participation, then stakeholders can provide input into what changes are desirable from their perspective. Additionally, stakeholder participation can provide societal and cultural inputs to the process through performance measures. Participation can increase stakeholder engagement and provide opportunities to keep abreast of changes.
- **Ability to serve as an oversight tool for ecosystem restoration initiatives.** The process of adaptive management ideally stimulates processes which inform reflection on the overall progress toward a program's goals. This includes monitoring and evaluation of data and assessment of which strategies are most effective. By providing a central vehicle for the multiple stages of restoration, adaptive management has the potential to also facilitate oversight of these efforts.
- **Ability to generate fundamental information about the ecosystem being restored.** The natural processes in many ecosystems undergoing restoration are largely unknown. The process of active adaptive management can be used to obtain a better understanding of how an ecosystem functions. In turn, this may help construct models that reflect ecosystem processes and project future responses.

Potential Difficulties of Implementing Adaptive Management

Despite limited successes implementing adaptive management, there have also been difficulties implementing the concept. The adaptive management case studies discussed as an appendix to this report illustrate a number of common themes that have hindered adaptive management programs. These include issues with connecting science to the management of resources, the inability of some efforts to achieve consensus to recommend or implement changes, and issues associated with how much flexibility adaptive management programs have to implement changes. A summary of these issues includes:

- **Connecting experimentation to operational changes.** Some managers note that linking science and experimentation to operational changes is one of the biggest challenges for adaptive management going forward.[26] While adaptive management has had limited success generating agreement on preliminary research questions and scientific experiments, there are few examples of recommendations generated from adaptive management translating into major, long-term management changes. Some suggest this is partially due to

[26] Telephone conversation with Chad Spence, Platte River Recovery Program, August 26, 2010.

deficiencies in the linkages between planning, assessments, and outcomes of adaptive management decision-making.[27] Many adaptive management programs provide recommendations for changes to groups or policy officials, rather than automatically requiring that changes be incorporated. Adaptive management does not alter the fact that traditional regulatory or political channels must be considered when implementing major changes.

- **Failure to resolve fundamental value conflicts.** Adaptive management is often proposed as a tool to resolve resource management conflicts, but its ability to solve major issues has limitations. Ideally, the concept uses science to determine an optimal pathway for a project or program to achieve restoration. However, scientific conclusions are rarely unequivocal and may be understood differently among various stakeholders. In these cases, adaptive management may be attempted, but positions and value-judgments may be entrenched and consensus difficult to reach. DOI's Technical Guide states that in instances in which stakeholders cannot agree on fundamental issues such as objectives, adaptive management should not be employed.[28]
- **Lack of flexibility to implement changes to a program.** An inherent issue for many adaptive management programs is their flexibility to implement changes to a program or project that is not working. The flexibility of adaptive management programs can be limited by several factors. For example, initial assurances (or the perception of assurances) to stakeholders can limit the scope of changes. These assurances can be legal (e.g., abiding by existing laws or contracts), resource-based (e.g., assuring flood control), or financial (e.g., availability of sufficient funds for various activities), among other things. Additionally, flexibility of a program can also be limited by funding (e.g., there are insufficient funds to implement changes to a program).
- **General/undefined objectives and performance measures.** Some have criticized the goals of adaptive management programs for a number of reasons, including a general lack of goals, vague or undefined goals, or goals that are irreconcilable.[29] Problems of this sort may be the result of efforts to accommodate the demands of multiple stakeholders with varied interests. Without defined goals, it is difficult to monitor progress or measure success of an adaptive management effort.
- **Use of uncertainty as a means to delay action.** Adaptive management often highlights areas of uncertainty, and the results of adaptive management experiments are rarely unequivocal. This can lead stakeholders or managers to call for more experimentation and testing of alternatives before a path to restoration can begin. Ultimately, this may create delays in decision making for a program or project.

Other Lessons Learned

When utilizing adaptive management to implement or oversee ecosystem restoration, a number of issues may arise. This section outlines general differences among adaptive management efforts

[27] Donald F. Boesch, Patricia N. Manley, and Tehodore S. Melis, "The Future of Water Resources Management: Challenges and Overcoming Them," *Water Resources IMPACT*, vol. 8, pp 21-23.

[28] See DOI Technical Guide, p. 15.

[29] See for example, Susskind, p 49.

and their potential effects on the execution of these efforts. It cites specific examples of how adaptive management has been implemented in five discrete locations: Glen Canyon, Platte River, the Lower Colorado, the Missouri River, and the Everglades. For detailed discussion of each of these examples, see the **Appendix** to this report.

Complexity and Timing of Adaptive Management

The complexity of issues and timing of implementation for adaptive management are important factors that vary among individual projects. Depending on the size and scope of an initiative, it may be more or less difficult to determine and achieve an "optimum" level of restoration. If adaptive management is utilized for project selection for complex, multi-use projects, implementation is likely to be difficult. For instance, adaptive management may be utilized early in the restoration process to help select an over-arching restoration strategy for a complex restoration initiative. This puts the concept in the middle of the controversial process of program or project selection. Similarly, it may also be used on an existing project with multiple uses to determine the ideal means of balancing among various needs, including those related to "traditional" functions (e.g., water, power supply) and ecosystem restoration. One example of this in practice is the Glen Canyon Adaptive Management Program.[30] This effort involves a number of stakeholders and complex issues that have developed over time. Since long-term restoration efforts related to dam operations have the potential to alter operations that are important to many stakeholders, the program has encountered setbacks due in part to disagreements among these interest groups.

Alternatively, adaptive management can also be applied to an existing strategy, plan, or restoration project that has already been conceived or that is more narrowly focused. If an overarching "plan" has already been selected, then adaptive management can be used to evaluate the progress of initial projects or pilot program components, gradually changing project operations on the margin to achieve optimum restoration. For instance, in the case of the Everglades program, an overarching plan for restoration has already been authorized and, in some cases, projects have been initiated. It is expected that these projects will utilize adaptive management to optimize their operation, and perhaps prioritize future projects going forward. However, since the broad outlines of a restoration strategy have already been determined, the process may not be as controversial.

The size of an adaptive management program can also vary among restoration initiatives. In some cases, managers may use adaptive management to make minor adjustments to the operations of pre-existing projects with limited controversy or stakeholder interest. Often, efforts such as these can be incorporated right away and may not attract significant outside attention. In other cases, adaptive management can be applied at the programmatic level, where decisions are made to alter program components or sets of restoration projects. Changes at this level may be more controversial because they affect a larger swath of stakeholders and could represent significant changes in the program. Changes at this level can also be subjected to regulatory hurdles.

Leadership of Adaptive Management Initiatives

Responsibility for leadership and coordination for adaptive management initiatives varies among initiatives. Some initiatives have placed a large amount of responsibility for governing with the federal government. For example, the federal government appears to make most decisions regarding adaptive management in the Everglades, with some indirect input from stakeholders. Adaptive management efforts that have been largely framed by the federal government have been

[30] This program is discussed in more detail in **Appendix**.

criticized by some who support a more central role for stakeholders in framing and leading adaptive management. They contend that increased and meaningful participation for stakeholders will increase "buy-in" into the restoration initiative.

Some efforts have created more formal structures for stakeholder engagement but still allow the federal government to maintain control of these forums. The Glen Canyon Adaptive Management Program allows non-federal stakeholders to participate in a Working Group that is responsible for analyzing results from adaptive management actions and making recommendations to the Secretary of the Interior for changes. Some have noted that the federal government retains a significant amount of responsibility and control over these deliberations by having its own representatives in the Working Group. The Chair of the Glen Canyon Adaptive Management Program is selected by the Secretary of the Interior, and has usually been a political appointee.

Giving the federal government a central leadership role may allow for the preservation of some of the traditional decision-making authority that the federal government possesses under the regulatory decision-making model. However, some have also argued that such a leadership role opens adaptive management initiatives up to charges of insularity and political bias.[31]

Some initiatives have opted for a more collaborative leadership structure. The Platte River program was itself developed by multiple parties, which is reflected in the leadership of this adaptive management effort. The program was developed collaboratively by five original signatories: the Bureau of Reclamation (Reclamation), the Fish and Wildlife Service (FWS), and three states. The chair of the program's Governance Committee rotates among the five original signatories, which dilutes the federal role. Day-to-day leadership and administrative duties are carried out by an executive director who is also selected by the Governance Committee.[32] Collaborative leadership such as that in that Platte River program may cause the federal government to give up some of its traditional leadership and decision-making authority, but may increase buy-in among non-federal stakeholders.

An additional framework for leadership is having a third party administer an initiative. To some degree, all of the aforementioned governance committees involved in adaptive management efforts delegate some portion of their work to third parties. The Platte River Implementation Program hires its own Executive Director (not a federal employee) who works with a committee to coordinate science, reporting, and outreach. Some initiatives, such as the Missouri River Recovery Program, have hired third party conflict resolution specialists to convene meetings and facilitate discussions among stakeholders. Some argue that professional mediators are a crucial element in the consensus building process for adaptive management efforts, and should play a more prominent role in these efforts going forward.[33]

Stakeholder Representation and Interest

Governance Structure/Roles

The roles played by federal, state, and local stakeholders within a governance structure are important elements in an adaptive management effort. In particular, two components appear to be prominent for defining an adaptive management governance structure: the number and diversity of stakeholders involved and the role of these stakeholders.

[31] Susskind, p. 39.

[32] Correspondence with Chad Spence, Platte River Recovery Program, August 26, 2010.

[33] Susskind, p. 52.

Some initiatives, such as the Missouri River Recovery Program and the Comprehensive Everglades Restoration Program, are set up to be broadly inclusive. The main stakeholder forum providing input into the adaptive management strategy on the Missouri River is the Missouri River Implementation Committee (MRRIC), which includes approximately 70 stakeholders who work together to present the Corps with recommendations derived from adaptive management observations. Similarly, the CERP adaptive management plan for the Everglades currently allows for multiple stakeholders to provide comments to the Corps on proposed monitoring and restoration efforts, but it is not clear how direct the linkage will be between these stakeholder comments and actual decisions going forward. The extent to which these large entities will be able to successfully agree on and provide substantive recommendations for adaptive management efforts remains to be seen. Program managers acknowledge that the multitude of perspectives that must be considered during the adaptive management process could affect future efforts.[34]

Another approach has been to designate specific representation of stakeholder interests through a smaller working group. For the Glen Canyon Adaptive Management Program, 25 members representing different interests are appointed by the federal government to serve on the Working Group. This structure allows for some aspects of debate to be expedited, although it may not solve fundamental value conflicts among these groups. In the past, some have argued that to make any group "advisory" to the federal government dilutes its power and the investment of stakeholders in this process.[35] Additionally, the use of a limited number of federally appointed representatives in an adaptive management decision-making process could expose that group to charges that it is non-representative.

Decision Rules

Some note that a key component for an adaptive management effort is the "decision rule," or the rule(s) that determines the procedure for final recommendations by a governance body. Since deliberations and negotiations among competing interests are an important part of most adaptive management efforts, the importance of these rules can be magnified. There are many ways that decision rules can be constructed, and each approach has advantages and disadvantages. Some initiatives may allow for collaborative decision-making by stakeholders with consensus-based decision-making (where unanimous agreement is required), while other initiatives may use a similar collaborative decision-making approach, but allow for majority or super-majority votes when consensus cannot be reached. Conversely, other initiatives may retain central decision authority within the federal government, and not afford any actual decision authority for stakeholders and non-federal entities. Instead, they solicit input on a more informal level.

To date, most efforts that attempt to incorporate adaptive management have stated a preference for consensus-based decision making of some type. This type of decision-making attempts to ensure that multiple interests are being taken into account.[36] However, a key question for these efforts is what to do when consensus cannot be reached. Some efforts, such as the Platte River program, allow for a vote but structure the vote to make it indistinguishable from consensus. As previously noted, the Platte River requires a 9/10 vote for any motion that cannot achieve consensus. An advantage of this type of requirement is that any recommendation that does result from consensus or near-unanimous votes is that all stakeholders are forced to come to the table and negotiate. Once a recommendation is agreed upon, an adaptive management effort employing this form of decision rule may enjoy an added level of legitimacy. On the other hand, consensus

[34] See footnote 68.

[35] In the case of Glen Canyon, the Secretary of Interior has accepted most of the committee's recommendations to date.

[36] Camacho, p. 961.

or near-unanimous decision making can also make it difficult (and in some cases perhaps even impossible) to reach a final recommendation, especially for the most contentious resource management disputes.

A variation is to offer a similar collaborative decision-making model with a super-majority vote utilized when consensus cannot be reached. For instance, the Glen Canyon program requires 2/3 of its 25 members to pass a recommendation in those cases in which consensus cannot be reached. This contingency can be useful in arriving at a recommendation for contentious efforts involving a number of stakeholders who may be unlikely to reach a full consensus. However, some have noted that this form of decision-making may provide a disincentive for collaboration in the first place. The ability to force a vote on an issue remove the incentive to negotiate, a key component of the consensus-based model. Observers note that clear rules concerning these votes (especially if they make formal voting a "last resort") could help parties maintain good-faith negotiations.

Yet another method for incorporating outside contributions and making decisions for adaptive management efforts is to use a forum to solicit input on federal efforts from a wide array of non-federal stakeholders. In this model, the federal government might have a strong role in the final decision. The preferences and viewpoints of non-federal entities are stated in adaptive management workshops or other meetings. These preferences and suggestions are then transmitted to a federal decision-making body or decision-maker for consideration. A decision to change a part of the program or a project can then be made by one or more federal entities. The decision does not necessarily have to follow the recommendations or input from the stakeholders (i.e., there is no formal process for incorporating their input into the decision). This is similar to the process of adaptive management in the Missouri River and the Everglades programs. This decision-making model largely protects the authority of the federal government, while also ensuring that various interests are considered or at least voiced and transferred to decision-makers. Some argue that this mode of input is preferable to decision-making by a smaller group made up of representatives who work to achieve formal recommendations. These observers argue that in many cases, it is not appropriate for a small number of arbitrarily-chosen private parties to make decisions about public resources.[37] On the other hand, others might argue that since this mode of decision making does not provide any formal means of negotiating or providing a single, final recommendation. This may lead non-federal stakeholders to lose the incentive to participate in the substantive dialogue that adaptive management can demand.

Objectives and Milestones

Numerous sources have noted that a lack of clearly defined objectives and milestones can be problematic for implementing adaptive management. Generally, most observers agree that adaptive management requires goals or milestones to serve as a marker for guiding restoration. In its Technical Guide, the Department of the Interior notes that the identification of clear and measurable management objectives is required for adaptive management to be successfully implemented.[38] Case studies in adaptive management suggest that initiatives with vague or unquantifiable objectives or milestones might have problems with adaptive management. For example, one of the primary critiques of the Glen Canyon Adaptive Management Plan has been its lack of measurable objectives.[39] Observers note that in that case, neither Congress nor the Adaptive Management Working Group (AMWG) initially identified measurable goals for the

[37] Feller, p. 897.

[38] DOI Technical Guide, p. 11.

[39] Susskind, p. 25.

AMP, and this may have at times slowed the deliberations of the working group. Recent efforts by the Glen Canyon AMWG to incorporate a set of quantified Desired Future Conditions may eventually address this issue.

Some argue that the Platte River Program has achieved some progress in restoration by initially agreeing on an overall program objective of restoring habitat for federally listed endangered species, then setting specific goals that included acreage of restored habitat. In contrast to Glen Canyon, in the case of the Platte River, agreement on milestones and objectives preceded the creation of the adaptive management program itself. However, finalizing all of these agreements (and therefore meaningful progress on adaptive management itself) took almost ten years. Therefore, an important trade-off for policy makers to consider is whether to begin experimentation and adaptive management before objectives and milestones are agreed upon.

Balancing Flexibility and Certainty

Ecosystem restoration initiatives with an adaptive management process have to strike a balance between allowing the adaptive management process enough flexibility to be effective and providing enough certainty to stakeholders to make long-term decisions about using and conserving resources. From a scientific perspective, the adaptive management process is considered most effective when it has limitless flexibility to implement changes to a program or project to attain defined goals. Ironically, the flexibility to address uncertainty in an ecosystem can create uncertainty among stakeholders who depend on certain resources. For example, some agricultural areas in South Florida rely on flood control projects and managed water flows to contain flooding. If a restoration program or project is changed through an adaptive management process to lower these controls, some stakeholders would be concerned that their farms could flood. To counter this concern, several policy mechanisms have been created to fine-tune the balance between flexibility and certainty in ecosystem restoration initiatives with adaptive management. Most of these methods aim to establish some limit to the flexibility of adaptive management to implement changes by creating certainty for stakeholders. These mechanisms include:

- **Anticipating foreseen circumstances and creating mitigation plans.** Some adaptive management programs, such as the Lower Colorado Multi-Species Conservation Program, outline anticipated changed circumstances with mitigation alternatives for each anticipated change.[40] This provides stakeholders a picture of where and how adaptive management could change the trajectory of a program or project, thus lowering uncertainty. However, this approach also limits the flexibility of the adaptive management process to foreseen or anticipated circumstances. Some plans also outline changes proposed due to unforeseen circumstances, but these are treated differently and can be harder to implement for various reasons.
- **Providing regulatory, financial, resource, and legal assurances to stakeholders.** Some ecosystem restoration initiatives have fundamental assurances or boundaries that limit the flexibility for change. For example, there is a legal assurance associated with the Glen Canyon Adaptive Management Program: restoration activities must be implemented and operated to maintain requirements under other existing laws (including water and power deliveries). In the Everglades, existing water sources cannot be depleted by restoration projects,

[40] See **Appendix** for a detailed description of this process.

unless a substitute source of water equivalent in quantity and quality is found to replace the original.

- **Providing for stakeholder involvement in the adaptive management process.** Involving stakeholders in the adaptive management process could potentially lower the uncertainty of the changes associated with adaptive management by allowing them input into the process, thereby increasing stakeholder buy-in and allowing them an opportunity to support their priorities.

Role of Congress

The Congressional role in providing guidance for federal adaptive management programs can range from authorizing agencies to implement adaptive management to prescribing an adaptive management process in legislation. Previously, Congress has refrained from providing extensive guidance related to the structure and substance of individual adaptive management efforts. The primary means of authorization for adaptive management programs has been either to explicitly reference the concept of adaptive management in legislation and leave more detailed guidance up to the agency (e.g., Everglades restoration program) or provide broad authorization language that may be interpreted by the executive branch as a mandate for an adaptive management program (e.g., Glen Canyon program). Additionally, in several instances (including the Platte River program) adaptive management has been initiated with no Congressional guidance or authorization. Congress may choose to maintain this limited role in the authorization adaptive management programs. This would continue to provide the executive branch with a considerable amount of autonomy in conducting adaptive management, but would also make it the central party responsible for addressing concerns with these efforts.

Some contend that difficulties associated with ongoing adaptive management efforts could have at least in part be solved with more guidance from Congress.[41] If Congress decides to play a greater role in directing adaptive management programs, there are several potential areas which may be of interest to policymakers. If Congress chooses to weigh in on adaptive management efforts in legislation, it may provide guidance or oversight in several areas. Examples of ways in which Congress could provide oversight include:

- **Outline federal leadership responsibilities.** Congress could designate a federal representative or agency to be in charge of implementing an adaptive management program. For instance, in the Glen Canyon program, a Secretarial designee leads the working group. Such a designation could be made in legislation by Congress.
- **Assign stakeholder representation.** Congress could assign specific groups or numbers of stakeholders to committees to oversee and recommend changes to adaptive management efforts. Stakeholders could also be appointed to a committee in charge of creating the adaptive management program itself.
- **Mandate procedures.** Congress could specify procedures for carrying out adaptive management, including how the results from adaptive management research and monitoring are to be tied to operational or project-based changes in the ecosystem restoration initiative. For instance, Congress could require that changes to operations be subject to a vote by a working group, or that changes would be implemented solely at the discretion of program or project managers.

[41] Susskind, p. 34.

- **Set goals and objectives.** Congress may set broad or specific goals associated with an initiative. Recently, some initiatives (such as the Platte River and Glen Canyon initiatives) have moved towards quantitative restoration goals. Congress could establish formal goals as targets for restoration, or else require that goals be specified in a future strategy or plan. It could also require a formal reporting process (including reports to Congress) on the progress of an initiative.
- **Provide assurances to stakeholders.** Congress may provide assurances to stakeholders in the form of requirements that an adaptive management effort will not significantly alter certain ongoing operations or specified resource allocations.

Congress might consider variations in these potential actions to better suit the needs of individual ecosystem restoration initiatives. A "one model fits all" approach to addressing adaptive management might not work for all restoration initiatives given their varying objectives, resources, and scope. For example, restoration initiatives that have the potential to alter water supplies for users might need broader assurances in legislation that restoration water requirements for restoration will not exceed a certain level, or that the actual procedures for carrying out an initiative will be decided by a joint federal/non-federal working group. Conversely, adaptive management plans that address threatened or endangered species may need assurances that certain species will not be jeopardized by an adaptive management plan.

While more prescriptive congressional guidance has the potential to clarify some issues associated with adaptive management, it could also subject Congress to criticism by outside observers who disagree with part or all of the planning approach. Additionally, future changes to prescriptive or detailed programs could entail amending the underlying authorization, which could be more difficult than simply adopting changes within the program administratively. Thus, providing federal agencies with broad authority to construct individual adaptive management programs (as has largely been the practice to date) may in the long-run provide greater flexibility for changing the adaptive management process.

Congress could also address adaptive management by increasing its oversight of adaptive management in restoration initiatives. In the past, Congress has had limited oversight of adaptive management programs. However, it could weigh in at various stages of this process. For instance, in the early stages of developing an adaptive management governance structure, Congress could conduct oversight hearings that provide a forum to discuss issues such as stakeholder representation and management structures. It could also hold hearings outlining progress and problems implementing adaptive management. Finally, it may require periodic reviews of these efforts by independent evaluators, such as the Government Accountability Office or the National Academy of Sciences.

Concluding Remarks

The concept of adaptive management is straight-forward, but its implementation can be difficult. Theoretically, adaptive management uses the best available science and monitoring to guide a project or program towards its stated goals. However in practice, the ability of adaptive management to achieve its objectives is often burdened by political, economic, and sometimes cultural constraints and barriers. This has caused some to contend that adaptive management has been more influential as a concept than as a process for improving the management of natural resources.

Difficulties with adaptive management may be due to a number of factors, including the balance between the flexibility required to make changes to project operations and requirements for certainty among some stakeholder interests. An adaptive management program that has the authority to significantly infringe on the interests of multiple stakeholders (e.g., farmers might not be able to plan for crops if future water supplies are uncertain) is likely to be unwelcome among many stakeholders. In contrast, an adaptive management process that cannot implement any changes in response to research and monitoring might be ineffective. Compromise between these two extremes might not be fully satisfactory to any of the parties involved.

Another reason that adaptive management is rarely viewed as an unqualified success may be due, in part, to the complexity and depth of some of the resource challenges it purports to solve. Agreement to an adaptive management program by stakeholders is not the same thing as agreeing to a long term change in a group's objectives (e.g., operation or restoration), especially if such a change involves giving up something important. This may be why implementing the early stages of adaptive management, such as monitoring and experimentation, has generally been easier than collaboration and decision-making. An additional consideration is that meaningful changes in ecosystems due to restorative actions can take years, and measuring restoration progress is still preliminary for several ecosystems that are currently employing adaptive management.

The nominal experiences of some adaptive management efforts suggests that a number of other important considerations shape the practical application of the concept. Many of these relate to the governance of adaptive management initiatives. Important choices in framing and overseeing an initiative may include federal and non-federal roles in leadership and representation; the type of decision-making process that is used and the extent to which it fosters collaboration among all stakeholders; and agreement on a meaningful set of quantitative goals and objectives.

Adaptive management is currently guiding a number of large-scale ecosystem restoration initiatives, and is expected to play a significant role in future initiatives. Previously Congress has provided limited guidance for implementing adaptive management for ecosystem restoration initiatives. However, as the concept of adaptive management matures in practice, Congress may choose to weigh in more on this process, or even require federal agencies to develop a uniform set of guidelines for implementing adaptive management. As existing adaptive management efforts mature, Congress may also be asked to address the concept through appropriations and oversight.

Appendix. Case Studies and Maps

Case Studies in Adaptive Management

Adaptive management has been adopted to guide research and manage natural resources in multiple ecosystems throughout the country. This section provides brief summaries of several cases of adaptive management in different regions that demonstrate varying degrees of maturity in the implementation process, as well as varying approaches to governance, leadership, and implementation of adaptive management.[42] It provides a summary of each program's governance structures, activities to date, and in some cases, reviews of the successes and failures of each program. For a map of the geographical areas encompassed by these strategies, as well as other large-scale ecosystem restoration efforts employing adaptive management strategies throughout the United States, see **Figure A-5**.

Glen Canyon Dam Adaptive Management Program

One of the most comprehensive examples of an adaptive management program in the United States is the Glen Canyon Dam Adaptive Management Program (AMP). This program was initiated in 1997 in response to the 1992 Grand Canyon Protection Act (P.L. 102-575). This act required that the operations of Glen Canyon Dam mitigate impacts on downstream resources of the Colorado River while also maintaining and adhering to requirements under existing laws that govern the Colorado River (including water and power deliveries).[43] The AMP was formed to address uncertainty and seek balance among these competing requirements.

The central governing entity of the AMP is the Glen Canyon Dam Adaptive Management Working Group (AMWG, or Working Group). The Working Group is a Federal Advisory Committee comprised of 25 representatives from designated federal, state, private and non-profit groups, each appointed by the Secretary of the Interior (Secretary). It meets biannually and is responsible for making recommendations to the Secretary pertaining to operations of Glen Canyon Dam. The Working Group is chaired by a representative appointed by the Secretary of the Interior, who establishes meeting agendas, finalizes minutes, defines project outcomes, and guides other internal processes.

For its decision-making process, the AMWG employs a collaborative decision model that seeks consensus and employs a decision rule when consensus cannot be reached. The AMWG practices active adaptive management, which includes running experimental water flows to determine their effects on ecosystem parameters. Based on these results, it recommends changes to the Secretary of the Interior.

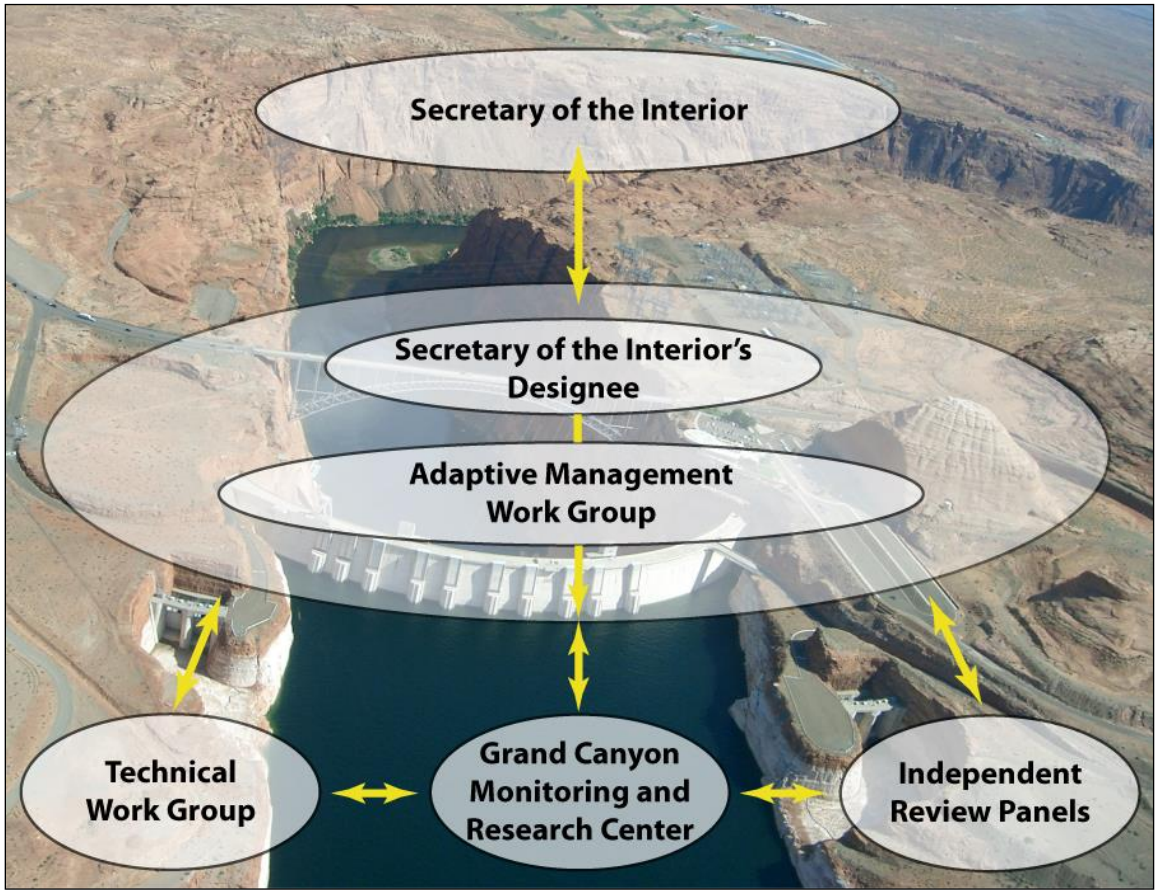
The Working Group considers information from several sub-groups, including research by the Grand Canyon Monitoring and Research Center (GCMRC, operated by the U.S. Geological Survey), as well as information from a Technical Working Group, which collaborates with the GCMRC. Additionally, it considers reviews by an independent science advisory panel, which

[42] These summaries are made for broad comparative purposes and are not meant to be exhaustive. References to program websites and/or documents should be consulted for more detailed information.

[43] Some contend that operations of Glen Canyon dam can have a negative effect on multiple species, including the endangered humpback chub. For more background on the formation of the Glen Canyon Adaptive Management Program, see Committee on Grand Canyon Monitoring and Research, *Downstream: Adaptive Management of Glen Canyon Dam and the Colorado River Ecosystem*, National Research Council, Washington, DC, January 1999. pp 77-80.

includes a number of subgroups of its own (see **Figure A-1**). The Working Group processes results from the various subgroups and makes recommendations for changes to the program to the Secretary of the Interior (via the designee) based on consensus or 2/3 majority votes.[44]

Figure A-1. Adaptive Management for Glen Canyon Dam



Source: Adapted by CRS based on documents from the Glen Canyon Adaptive Management Program. (http://www.gcdamp.gov/)

The AMP has recommended and conducted experimental water flows on multiple occasions over the past 13 years. These experiments have been extensively monitored and analyzed by the GCMRC, and have been used to inform research and ongoing management and operational changes to Glen Canyon Dam, including recommendations to the Secretary of the Interior for ongoing experimental flows and future adaptive management. Most parties agree that the scientific foundation of the program has improved scientific understanding of the Colorado River ecosystem.[45]

[44] The Secretary's designee decides when consensus is not possible and therefore a majority vote of 2/3 is required.

[45] See for example, National Research Council (2004), pp 79-80. For general lessons learned by those involved in the program itself, see Dennis M. Kubly, "Environmental Protection: Using Adaptive Management at Glen Canyon Dam," available at http://www.hydroworld.com/index/display/article-display/9751553848/articles/hydro-review/volume-28/issue-7/articles/environmental-protection.html.

Despite improved knowledge of the ecosystem, some have concluded that the Glen Canyon program has failed to address the fundamental concerns that led to its creation.[46] Specifically, they contend that the AMP has not resolved the fundamental question of how power generation should be reconciled with other water uses, including environmental flows.[47] Critics have noted several factors that may contribute to this perceived failure, including issues with the program's leadership, governance structure, and actions.[48] For instance, observers argue that although the AMP provides a useful experimental approach for monitoring and evaluating dam operations (thus improving scientific understanding of the ecosystem), a similar feedback mechanism to monitor and adjust the regulatory program in response to this information has not been developed.[49] Furthermore, they argue that the work of the program has been made more difficult because neither Congress nor the AWWG identified measurable goals for the restoration program.[50] Without measurable goals, attaining agreement on operational changes can be difficult.

Some have also criticized the structure of the collaborative decision-making model under the AMP.[51] The Working Group itself acknowledged the failure of AMP participants to reach consensus on several important issues, and cites a lack of collaboration as a major concern.[52] Some note that the option of a 2/3 majority vote may have the effect of discouraging negotiation and collaboration, and may even lead to entrenched voting blocs in many cases. Further, the central authority within the Department of the Interior (i.e., the Secretary's designee) has been criticized by some who argue that the designee (or DOI) possesses too much authority over the AMP, and plays too prominent of a role in its funding and structural design, including the initial selection of voting representatives.[53]

Among observers, there is no consensus on whether the difficulties that the Glen Canyon program has encountered are unique to this particular program or whether they are fundamental to the related processes of adaptive management and collaborative decision making. Recently DOI has attempted to make several substantive modifications to revamp the program. Among other changes, the Department has moved toward achieving agreement on quantifiable targets for Desired Future Conditions (DFCs) that would more clearly establish objectives for management activities to target. The AMWG has recommended proposed narrative DFCs to the Secretary, but it has yet to agree on quantitative targets.[54]

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[46] Lawrence Susskind, Alejandro E. Camacho, and Todd Schenk, "Collaborative Planning and Adaptive Management in Glen Canyon: A Cautionary Tale," *Columbia Journal of Environmental Law*, vol. 35, no. 1 (March 2010), p. 24. In a 2007 report, the Roles Ad Hoc Group outlined many similar concerns.

[47] Camacho, p. 955.

[48] See generally, Alejandro E. Camacho, "Beyond Conjecture: Learning About Ecosystem Management from the Glen Canyon Dam Experiment," *Nevada Law Journal*, vol. 8, no. 942 (Spring 2008), pp. 942-963; and Susskind, Alejandro E. Camacho, and Todd Schenk, "Collaborative Planning and Adaptive Management in Glen Canyon: A Cautionary Tale," *Columbia Journal of Environmental Law*, vol. 35, no. 1 (March 2010), pp. 942-963, and Susskind, pp 1-54.

[49] Camacho, p. 955.

[50] Susskind, p. 25.

[51] Joseph M. Feller, "Collaborative Management of Glen Canyon Dam: The Elevation of Social Engineering over Law," *Nevada Law Journal*, vol. 13, no. 53 (Spring 2008), pp. 896-941.

[52] See Roles Ad Hoc Group, *Report and Recommendations to the Secretary's Designee*, Glen Canyon Dam Adaptive Management Work Group, August 2009, p. 3. http://www.usbr.gov/uc/rm/amp/amwg/mtgs/07aug29/Attach_13a.pdf.

[53] Camacho, p. 953.

[54] See meeting minutes available at http://www.usbr.gov/uc/rm/amp/amwg/mtgs/10aug24/Draft_Mins_revlw.pdf. In her initial memo to the chairs of the Ad Hoc Working Group, DOI Assistant Secretary Castle noted that she expects phase 2 of this process (developing quantifiable goals) to be difficult. See, Memorandum from Anne Castle, Assistant

Platte River Adaptive Management Plan

The Platte River Adaptive Management Plan is part of the larger Platte River Recovery Implementation Program (Implementation Program). It is designed to provide Endangered Species Act (16 U.S.C. §§1531-1543; ESA) compliance for existing and certain new water-related activities in the Platte River Basin. The program originated in a 1997 Cooperative Agreement between the Governors of Colorado, Nebraska, and Wyoming, and the Secretary of the Interior that created a program to conserve and protect the habitat of federally listed species in the river basin.[55] The signatories worked together to establish a Governance Committee (made up of 10 voting members, including the signatories) whose charge was to formulate a detailed program to improve and maintain habitats of four target species on the Platte River, and to provide compliance under the ESA for certain existing and future water activities in each state. Members of the Governance Committee collaborated to form the structure and substance of the adaptive management program over the next 10 years.

The Adaptive Management Plan (AM Plan) was formulated by the Adaptive Management Working Group of the Governance Committee, and was introduced in 2006. The Plan guides all adaptive management work for the Platte River Recovery Implementation Program.[56] The AM Plan has four central objectives pertaining to species management (including milestones for habitat and flows) and two priority hypotheses for testing.[57] Observers note that the inclusion of the two hypotheses represents a significant compromise between two fundamentally different visions for ecosystem restoration. While the parties were not able to agree on a vision for restoration for the river, they agree that the habitat of listed species needs to be enhanced.[58]

Under the AM Plan, the Governance Committee (which includes multiple stakeholders) is responsible for all policy decisions pertaining to the adaptive management part of the Implementation Program, including any changes to proposed management activities. Governance Committee decisions are made by consensus, or a 9/10 vote when consensus cannot be reached. [59] A rotating chair (a representative of one of the five original signatory organizations) is responsible for coordinating the Governance Committee. Similar to adaptive management for the Glen Canyon program, multiple subgroups advise the working group with both technical and financial/coordination support. These subgroups are centrally coordinated through an Executive Director (hired by the Governance Committee), who works with his/her own staff to carry out

Secretary for Water and Science, Department of the Interior, to George Caan and Larry Stevens, Co-Chairs, Desired Future Conditions Ad Hoc Group, February 23, 2010, http://www.usbr.gov/uc/rm/amp/amwg/mtgs/10aug24/Attach_11a.pdf.

[55] David M. Freeman, "Negotiating for Endangered and Threatened Species Habitat in the Platte River Basin," in *Large-Scale Ecosystem Restoration: Five Case Studies from the United States*, ed. Mary Doyle and Cynthia A. Drew (Washington, DC: Island Press, 2008), p. 71.

[56] The full plan is available in Attachment 3 at http://www.platteriverprogram.org/PubsAndData/ProgramLibrary/Platte%20River%20Recovery%20Implementation%20Program%20Document.pdf.

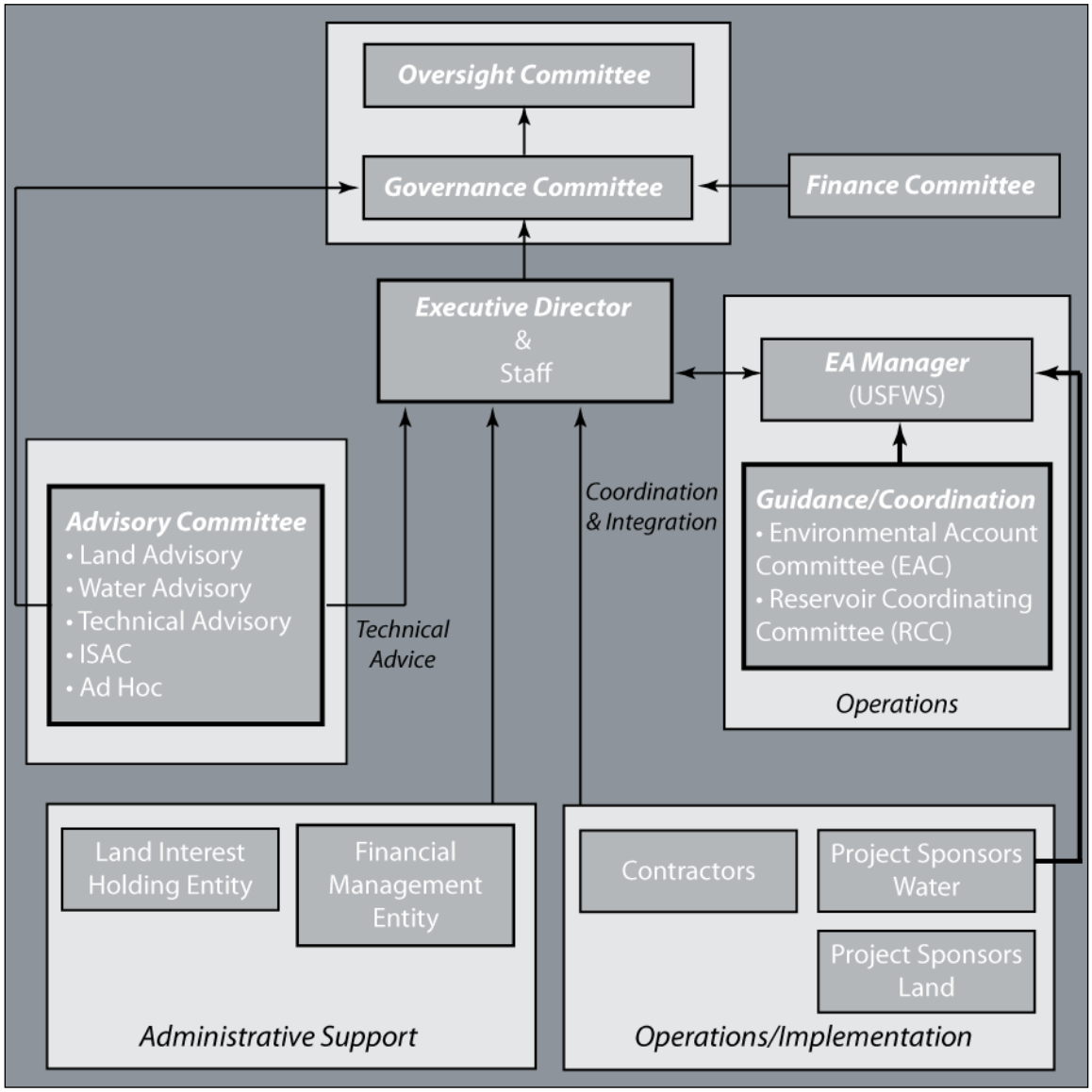
[57] The four stated objectives are: (1) improve production of Interior Least Terns and Piping Plovers from the central Platte River; (2) improve survival of Whooping Cranes during migration; (3) avoid adverse impacts from actions on Pallid Sturgeon populations; (4) provide benefits to other species that use the Platte River and reduce the likelihood of listing those species. See http://www.platteriverprogram.org/AboutPRRIP/Pages/AdaptiveManagement.aspx. The two hypotheses are classified as: (1) flow-sediment mechanical (which uses water flows to rehabilitate the river) and (2) mechanical creation and maintenance (which uses mechanical means, such as bringing in off-channel sand and water to rehabilitate the river).

[58] Freeman, p. 82.

[59] To date, this has happened only once. All other major actions by the Governance Committee, including the original adaptive management plan, were approved by consensus.

program activities at the direction of the Governance Committee. A diagram of this governance structure is shown in **Figure A-2**.

Figure A-2. Platte River Recovery Implementation Program- Adaptive Management



Source: Adapted by CRS by Platte River Recovery Program documents.
Notes: ISAC stands for Integrated Science Advisory Committee.

To date, no major outside review of the Platte River Implementation program has been conducted. However, the program's plan is notable for its level of detail, which was negotiated among stakeholders over the course of 10 years. Despite the relative maturity of the overall initiative, it has not attracted the level of criticism of the Glen Canyon AMWG.[60] Since 2007, the Implementation Program has achieved consensus on several major action items, including

[60] This may be due to a number of reasons, including the higher profile nature of the GCAMWG resulting from its relationship to the Grand Canyon ecosystem, as well as the limited implementation of actual efforts on the ground for the Platte program, including science and monitoring efforts.

preliminary progress on hypothesis testing and achievement of all preliminary program milestones. Only one vote has been required, and in that case the motion passed nine to zero (with one abstention).[61] Progress toward achieving the program's primary objectives (including its additional milestones) is to be evaluated annually, and based on these evaluations, the Governance Committee will consider changes to ongoing work under the Plan.

Missouri River Recovery Program (MRRP)

The Missouri River Recovery Program (MRRP) provides an example of an adaptive management program that is still in the early stages of development. MRRP was authorized by Congress in §5018 of the Water Resources Development Act (WRDA) of 2007 (P.L. 110-147), and established by the Corps in 2008.[62] The program consists of activities to restore the Missouri River ecosystem and recover three federally listed species: Pallid Sturgeon, Interior Least Tern, and Piping Plover. Actions are being taken by the Corps to meet the requirements laid out in the U.S. Fish and Wildlife Service's (FWS) 2000 Biological Opinion (later amended in 2003).[63] The Corps has committed to using adaptive management as a guiding principle for this initiative, and has published a draft of its framework for conducting adaptive management activities.

Adaptive management for the MRRP is expected to be conducted through a mix of federal and non-federal entities, and is currently being developed by federal officials within the Corps and FWS.[64] However, in accordance with current law, ultimate management authority is expected to reside with the Corps. The Adaptive Management Work Group (AMWG) is proposed to be the primary lead entity to develop adaptive management strategies for the MRRP. The AMWG is made up of Federal and State agencies, academics and consulting expertise.[65] Strategies formulated by the AMWG are to focus on sets of related actions/projects, which the AMWG plans to use to inform the relevant bodies within the Corps (most notably, project managers and product delivery teams) in the development and implementation of adaptive management strategies and reviews. Several other entities would also work to support adaptive management strategy development and implementation for the MRRP by providing scientific information and coordinating functions.[66] (A chart depicting these various entities is provided in **Figure A-3**.

[61] To date, the one item to come to vote involved the state of Colorado amending its depletions plan from the original plan. Phone conversation with Jerry Kenny, Executive Director, Platte River Recovery Program. August 26, 2010.

[62] For more background on this program, see the Program website at http://www.moriverrecovery.org/mrrp/f?p=136:3:2993805158608038::NO.

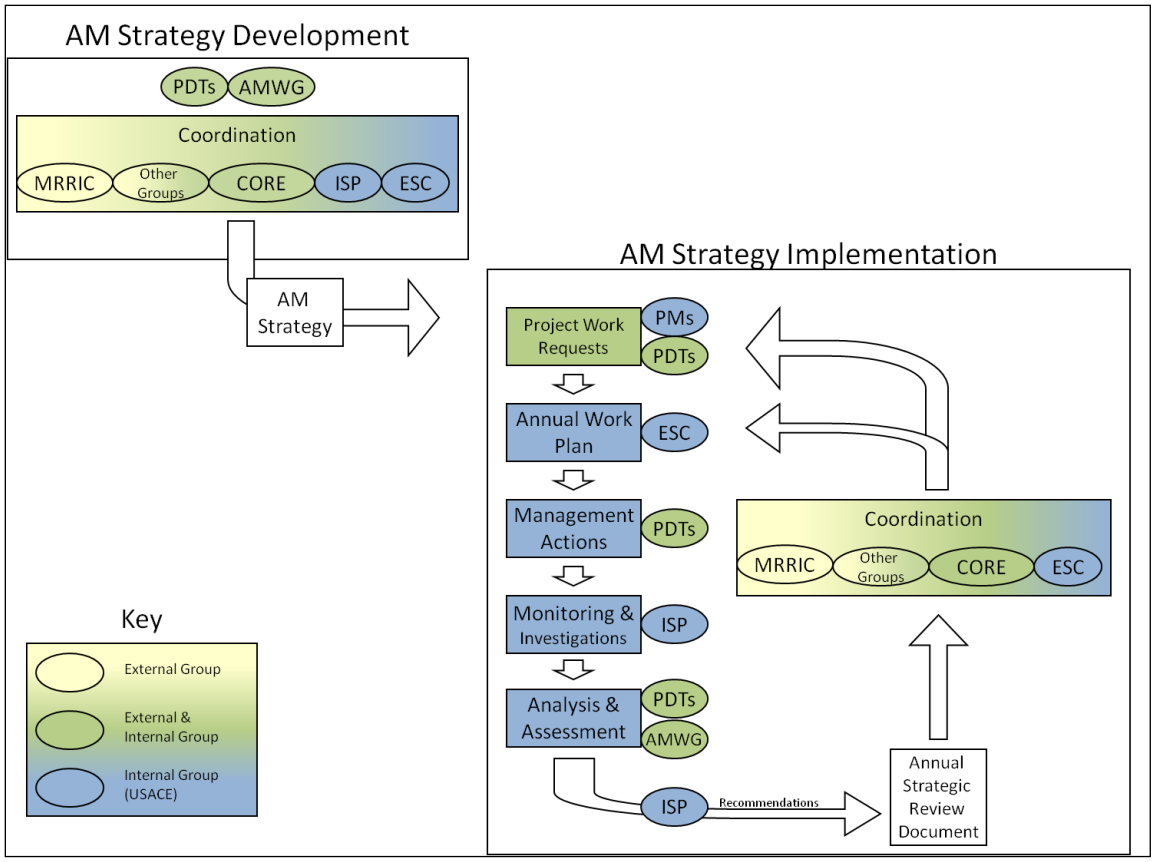
[63] See CRS Report R40185, *The Endangered Species Act (ESA) in the 111th Congress: Conflicting Values and Difficult Choices*, by Eugene H. Buck et al.. A Biological Opinion is a written statement analyzing whether a proposed agency action is likely to jeopardize the continued existence of a listed species or to destroy or adversely modify critical habitat.

[64] Email correspondence with Theresa Reinig, U.S. Army Corps of Engineers, September 20, 2010.

[65] According to the Corps, the exact make-up and representation has not been announced.

[66] Most notably, these include the Cooperation for Recovery Team (CORE, which provides for monitoring), the Independent Science Review Panel (ISP, which provides independent peer review) and the Executive Steering Committee (ESC, which includes leadership from multiple Corps districts).

Figure A-3. Draft Adaptive Management Process Under MRRP



Source: Joe Bonneau, et. al. *Draft Missouri River Recovery Program Adaptive Management Process Framework*, July 2, 2010.

Notes: Acronyms used in this figure include: AMWG – Adaptive Management Working Group, CORE – Cooperating for Recovery Team, ESC – Executive Steering Committee, ISP - Integrated Science Program, MRRIC – Missouri River Recovery Implementation Committee, PDT – Project Delivery Team, PM – Project Manager.

The primary non-federal collaborative forum for Missouri River recovery activities will be the Missouri River Implementation Committee (MRRIC, or Implementation Committee). The MRRIC was also authorized in WRDA 2007 (§5018). It has 70 members, including 28 non-governmental stakeholders (representing 16 categories), eight states, 18 American Indian Tribes, and 13 federal agencies.[67] The committee has a rotating chair who is selected by the MRRIC. The MRRIC currently makes its advisory recommendations to the Secretary of the Army based on consensus vote. In cases where consensus cannot be reached, additional meetings can be called. There are no decision rules or voting requirements to force a decision in these situations.

Although the Corps and FWS have committed to using adaptive management as a tool for implementing the MRRP, these entities have yet to finalize a formal mechanism for non-federal stakeholder participation. To date, the MRRIC has only informally coordinated with MRRP on adaptive management activities, including an emergent sandbar habitat project and environmental assessment by the Corps.[68] While the Corps has committed to a set of principles for future

[67] A full roster of the current members is available at http://www.moriverrecovery.org/mrrp/f?p=136:302:2993805158608038::NO.

[68] Telephone conversation with Teresa Reineig, Missouri River Recovery Program. September 17, 2010.

adaptive management efforts, it is not known whether future structures will fully incorporate the broad base of stakeholders reflected in the MRRIC, and how this might change the profile of current and future efforts.

Since the MRRP has yet to finalize and begin implementing its adaptive management processes, there have been no formal reviews of the program's use of the concept to date. However, going forward, program managers note that one of the main challenges for the adaptive management program under MRRP will be to incorporate feedback from its broad base of stakeholders.[69] Key choices may include the number and proportion of representation by various interest groups.

Lower Colorado Multi-species Conservation Program

The Lower Colorado Multi-species Conservation Program (MSCP) is a multi-stakeholder initiative to conserve 26 species along the Lower Colorado River while maintaining water and power supplies for farmers, tribes, industries and urban residents.[70] The MSCP began in 2005 and is expected to last for 50 years. The primary driver to implement the MSCP is achieving compliance under the ESA for federally listed species. To achieve compliance under ESA, the Bureau of Reclamation (BOR) consulted with FWS and obtained a Biological Opinion (BiOp) with a duration of 50 years.[71] Non-federal entities received an incidental take permit for the same period. In exchange, these interests agree to support efforts to improve habitat and fish and wildlife populations.

The MSCP is managed by a set of program documents that include the 2005 Biological Opinion, 2004 Biological Assessment, 2005 Section 10(a)(1)(B) Incidental Take Permit (Incidental Take Permit), Environmental Impact Statement/Environmental Impact Report, Funding and Management Agreement (FMA), Implementing Agreement (Agreement), and Habitat Conservation Plan (HCP).[72] The Lower Colorado Adaptive Management Program (LCAMP) was developed by the MSCP to address scientific uncertainty in habitat creation and fish augmentation methods and changed or unforeseen circumstances in the implementation of the MSCP. The LCAMP is implemented by Bureau of Reclamation (BOR). BOR, in consultation with a Steering Committee (consisting of Parties to the Implementing Agreement[73]), appointed a Program Manager to run the MSCP and consequently the LCAMP. The LCAMP is expected to use the best scientific and commercial information available, additional monitoring and research, and scientific reviews to evaluate the effectiveness of existing and proposed conservation measures under the MSCP.

Adaptive management in the LCAMP involves consultation among the Program Manager, the Steering Committee, and FWS. A monitoring and research program conducts studies to evaluate techniques used to create habitat and augment fish populations. These data provide a basis for

[69] See footnote 68.

[70] The stakeholders include six federal and state agencies, six tribes, and 36 cities and water and power authorities.

[71] See footnote 63.

[72] For actions without a federal nexus (i.e., no federal funding, permit, or license), the Secretary of the Interior may issue permits under Section 10(a) of ESA to allow the incidental take, or any action that adversely affects a species during otherwise lawful actions. An applicant for a permit is to submit a habitat conservation plan (HCP) that shows the likely impact of the planned action; steps taken to minimize and mitigate the impact; funding for the mitigation; alternatives considered and rejected; and any other measures the Secretary may require (50 C.F.R. § 17.22).

[73] The Implementing Agreement lays out terms and conditions for implementing the MSCP. It also lays out the process for conducting adaptive management under the program. The Steering Committee consists of 35 members, including five representatives each from the following entities: Department of the Interior, Arizona, California, Nevada, Indian Tribes, environmental organizations, and other private or public entities.

modifying existing projects or developing alternatives for future projects. Modifications generated by the LCAMP are proposed to the Steering Committee with an estimate of costs. They are also identified in the annual implementation report, work plan, and budget. The Steering Committee evaluates proposed changes to ensure that they are consistent with the MSCP goals and can be accomplished within budget limits. Action plans and budgets that reflect proposed changes are reviewed by FWS for concurrence that they conform to the terms and conditions of the incidental take permit issued for the program.[74]

Changes to actions proposed under the LCAMP fall under two categories: foreseen and unforeseen changes. Changes that are envisioned under the HCP (i.e., *foreseen changed circumstances*) do not require an amendment to the MSCP, the Agreement, or Incidental Take Permit. Foreseen changed circumstances have remedial measures listed in the HCP that can be implemented.[75] If changed circumstances occur that have not been contemplated under the HCP (i.e., *unforeseen circumstances*), they are to be resolved within the framework of regulations addressing HCPs.[76] The Director of the U.S. Fish and Wildlife Service (Director) is responsible for determining if unforeseen circumstances exist.[77] Proposed minor changes due to unforeseen circumstances are not expected to require an amendment to the MSCP, the Permit, or the Agreement. This implies that the adaptive management process might not lead to changes in the program documents, which is an assurance to stakeholders who have based their plans on the actions and framework of the documents. However, significant changes due to unforeseen circumstances can require a change to the MSCP. The costs of addressing unforeseen circumstances are limited for non-federal stakeholders. The commitment of additional land, water, or financial compensation, or additional restrictions on the use of land, water, or other natural resources beyond the level specified in the plan cannot be demanded by the federal government without the consent of stakeholders covered under the Permit.[78]

No studies have been completed that evaluate the LCAMP's effectiveness. The future success of adaptive management, however, could be tied to the foreseen and unforeseen circumstances included in the program documents. If future conditions are limited to those envisioned under foreseen circumstances, future efforts (including changes) will be more straightforward. While some contend that these foreseeable changes and their mitigation measures are limited in scope in the MSCP, others contend that the list of foreseeable changes is comprehensive for the 50-year time frame and the chance of an unforeseen change is small. Notably, the MSCP does not directly address climate variability as a foreseen circumstance, although it does address the potential effects of climate change in the region (e.g., lower water supplies and drought). The remedy for these circumstances is to prioritize the distribution of available water among habitats to ensure the

[74] 2005 Section 10(a)(1)(B) Incidental Take Permit (Incidental Take Permit) under the Endangered Species Act.

[75] Some contemplated changed circumstances include failure to provide essential habitat for one or more covered species; insufficient water availability for habitat; loss of marsh and woody habitat due to floods; loss of fish in rearing facilities; failure of fish augmentation techniques to meet population goals; toxic spill in the conservation area; and future listing of a non-covered species. Some remedial measures include creating new habitat and increasing fish numbers through alternative techniques; as well as prioritizing the distribution of available water among habitats in situations of water scarcity.

[76] The Agreement states that unforeseen circumstances will be handled according to FWS regulations 50 CFR §§17.22 and 17.32.

[77] 50 CFR §17.22(b)(5)(iii)(C).

[78] 50 CFR §17.22(b)(5)(iii)(A).

greatest benefits for covered species. However, 'available water' is not defined, and if available water is not sufficient to address habitat requirements it is unclear what the next steps might be.[79]

A common criticism of adaptive management is whether the process has enough flexibility and authority to implement changes in a conservation program. Flexibility in adaptive management generally reflects two key factors: (1) the steps involved in approving a change to the initiative; and (2) the size of the change allowed. The MSCP has a process for making changes to the program that involves approval by the Steering Committee and concurrence by the FWS. If the proposed change does not pass either of these two steps it appears that there is no additional process that would result in implementation. Under the Agreement, it states that "each Party shall, to the maximum extent practicable, fully cooperate with the AMP."[80] A change passed through the AMP might not be implemented by a Party if it is not *practicable*. The limits of what is practicable are not defined, and it is unclear what the consequences might be for a party not cooperating or participating in the AMP.

Everglades Restoration

The Everglades is a unique network of subtropical wetlands in Florida that has shrunken to half its original size. In response to the overall decline of the ecosystem, federal, state, tribal, and local agencies collaborated to develop the Comprehensive Everglades Restoration Plan (CERP). CERP aims to increase storage of wet season waters to augment the supplies during the dry season for both the natural system and urban and agricultural users. Federal restoration of the Greater Everglades ecosystem is guided by the Water Resources Development Act of 2000 (WRDA 2000; P.L. 106-541). Under §601 of this act, Congress approved CERP as a framework for Everglades restoration. The law also authorizes the creation of programmatic regulations for implementing CERP, which aim to ensure that new information resulting from changed or unforeseen circumstances, new scientific or technical information, information generated through the use of adaptive management, and future authorized changes to CERP, are incorporated into CERP.[81] WRDA also authorized funding for an adaptive assessment and monitoring program. An outline of this program was promulgated as a regulation in 2003.[82] Since then, multiple documents to guide adaptive management efforts have been produced. However, since few restoration projects have been initiated, there have been limited opportunities to put adaptive management plans into action.

Adaptive management is expected to be conducted at the programmatic and project level in the Everglades as new restoration projects are initiated. At the programmatic level, adaptive management is to be used to adjust the monitoring and assessment plan, project components, sequencing of implementing projects, and operations of multiple projects. At the project level, adaptive management is to be tailored to fit each project, including its degree of complexity and its potential number of management or implementation options. Implementation guidance for restoration projects requires that all ecosystem restoration projects under CERP have an adaptive management plan. The project is also to be structured so that it can incorporate uncertainty and operate effectively under variable conditions.[83]

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[79] For example, the measures do not specify if additional water will be procured if it is needed for habitat requirements of covered species.

[80] §11.4 of the Implementing Agreement.

[81] §601(h)(3)(C).

[82] 33 CFR §385.

[83] *AM Strategy*, p. 4.

Pursuant to the 2003 regulations, adaptive management in the Everglades is guided by the Restoration, Coordination and Verification (RECOVER) team, which is responsible for the science and monitoring of CERP. RECOVER is comprised of the RECOVER Leadership Group (RLG), which is the primary coordinating body in this effort, three supporting technical teams (Planning, Evaluation, and Assessment) and a management body. The RLG includes 12 members who have an equal role in decision making.[84] RECOVER is responsible for, among other things, developing system-wide performance measures for evaluating projects and goals, preparing project implementation reports, developing proposals for a monitoring plan for CERP, conducting adaptive assessment activities, considering proposed revisions to CERP, and developing interim goals for CERP. An overview of the adaptive management framework under CERP is provided in **Figure A-4**.

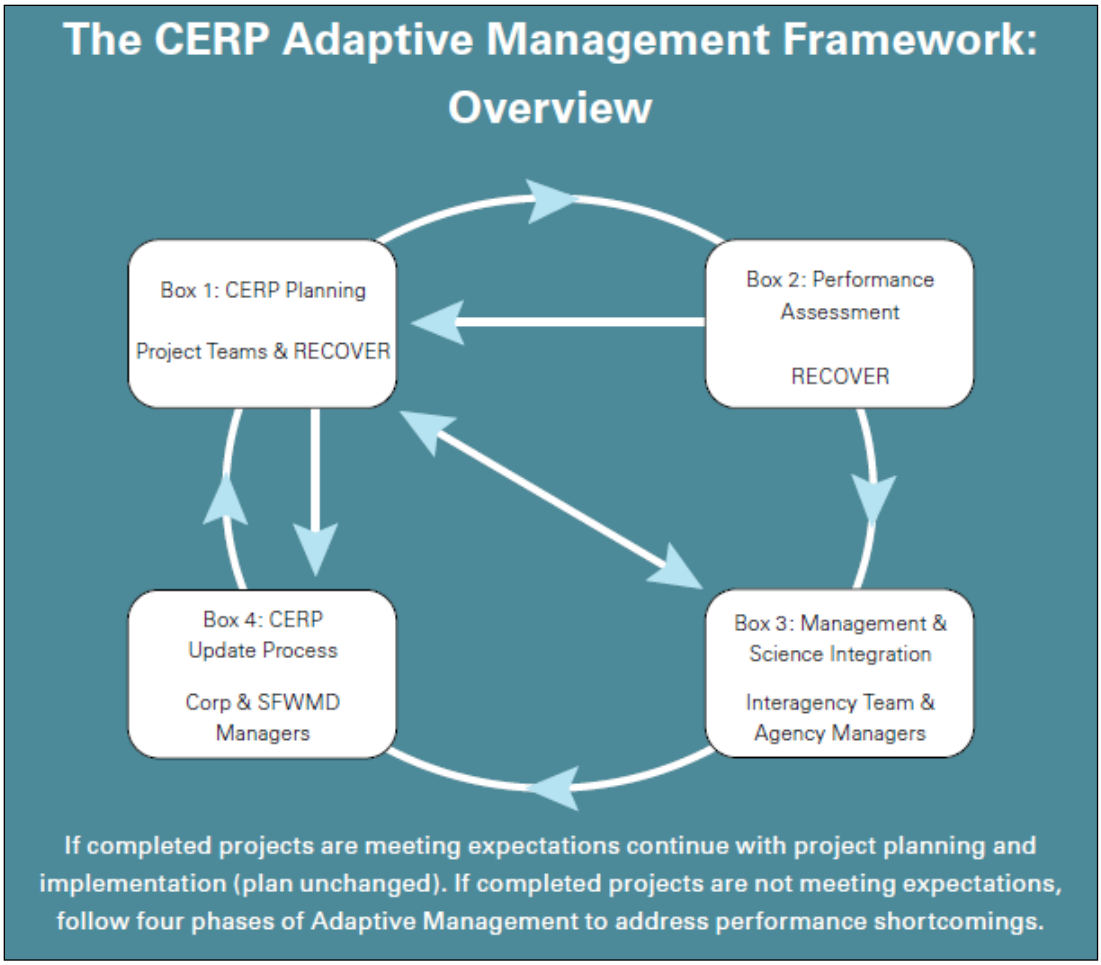
Notably, RECOVER is not responsible for management and science integration in the form of actual changes or updates to CERP. This task resides within an entity known as the System Planning and Operations Team (also known as the SPOT) and the Corps of Engineers. If CERP, or any of its components are to be changed, the Corps, in consultation with other federal, state and tribal agencies, is to prepare a report detailing the changes. Changes are expected to fall in one of three categories, including (1) Altering the sequencing of project implementation to adjust the storage, treatment, or delivery of water; (2) Implementing operational changes to improve a project; and (3) Adjusting CERP, including adding, deleting, or modifying projects.[85] If the changes to a project or to CERP are significant, Congressional authorization is needed.[86]

[84] The RLG consists of program managers from the Army Corps of Engineers and South Florida Water Management Districts, plus representatives from the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, U.S. Geological Survey, National Park Service, Miccosukee Tribe, the Seminole Tribe, Florida Department of Agriculture and Community Services, Florida Department of Environmental Protection, and the Florida Fish and Wildlife Conservation Commission.

[85] U.S. Army Corps of Engineers, *Comprehensive Everglades Restoration Plan Adaptive Management Strategy*, April 2006, p. 6. Hereafter known as the *AM Strategy*.

[86] The Corps defines the circumstances under which a project change requires additional authority in Engineering Regulation 1105-2-100.

Figure A-4. Adaptive Management Under CERP



Source: U.S. Army Corps of Engineers, *Comprehensive Everglades Restoration Plan Adaptive Management Strategy*, April 2006.

Two documents are expected to guide adaptive management in the Everglades under the RECOVER program: the CERP Adaptive Management Strategy (AM Strategy) and the CERP Adaptive Management Integration Guide (AM Guide). The AM Strategy sets up a learning process to better understand the South Florida ecosystem and is to incorporate improvements to CERP when new scientific and technical information becomes available. When it is published, the AM Guide is expected to identify specific steps for implementing adaptive management at the program and project levels.

Stakeholder participation in the adaptive management process under CERP consists largely of reviewing and commenting on various reports during each of the stages of adaptive management process. There is no formal advisory body with stakeholders that addresses adaptive management in the Everglades. Furthermore, due to Federal Advisory Committee Act (FACA) constraints, Corps Project Development Team meetings, as well as RECOVERY team meetings, currently do not allow for a direct dialogue between government and non-government stakeholders.[87]

[87] U.S. Army Corps of Engineers, *Draft Comprehensive Everglades Restoration Plan Adaptive Management Integration Guide, Vers. 3.2*, March 2010, p. 3-4. Hereafter known as the *AM Integration Guide*.

Due to the ongoing nature of the process to refine adaptive management planning, combined with the reality of few projects being initiated to date, there are no major examples of adaptive management being implemented for CERP projects. However, some have analyzed the current adaptive management process in the Everglades and provided feedback. One criticism of adaptive management in the Everglades is that it only involves broad, indirect stakeholder participation in the process of making changes to CERP projects.[88] Stakeholder participation in the process is largely based on reviewing and commenting on documents produced by various adaptive management committees, and there is no single forum for direct stakeholder participation and recommendations.

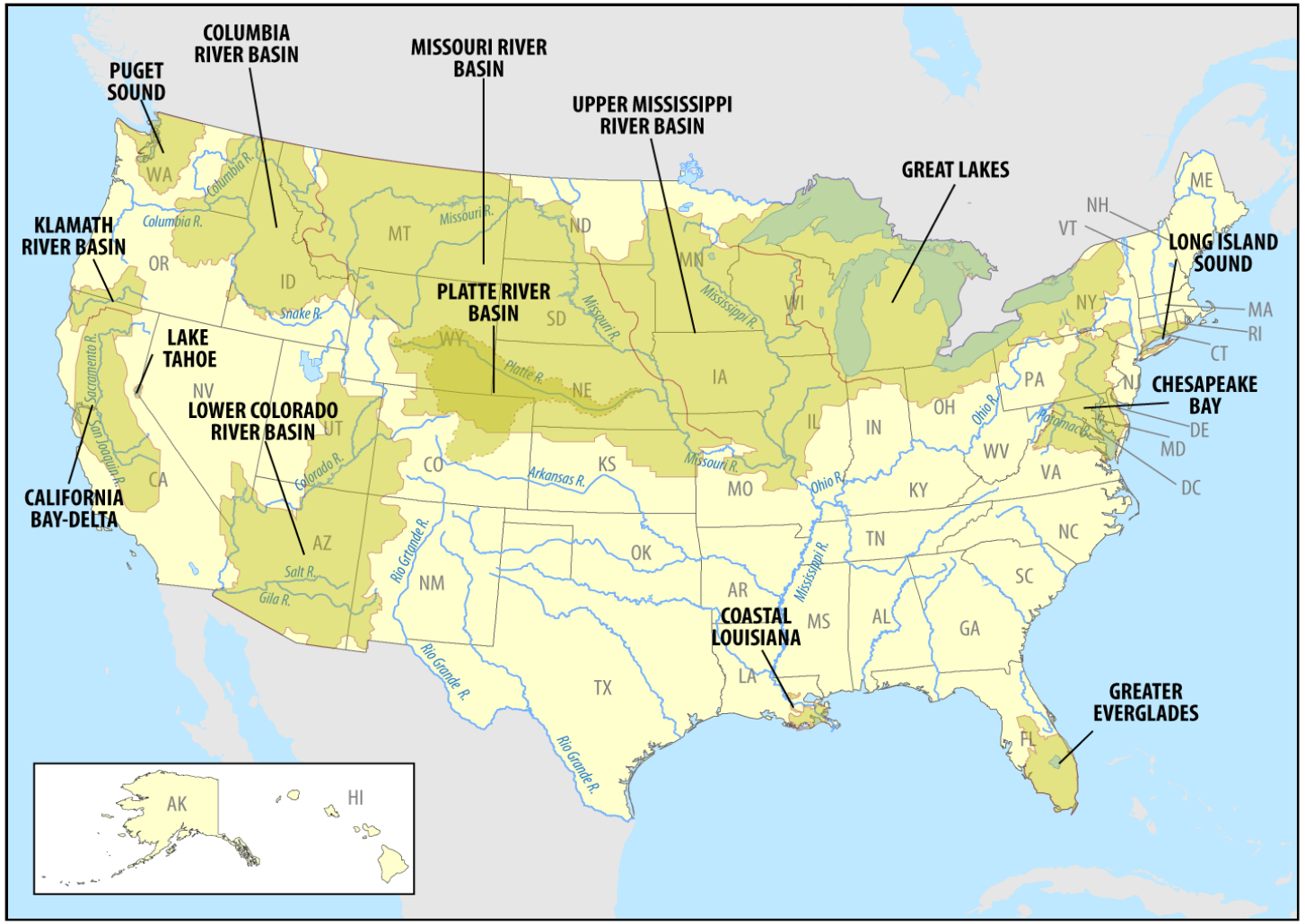
Some contend that the lack of a central committee or forum for non-governmental stakeholders to contribute to decision-making may deprive the effort of a "space" in which stakeholders can discuss these issues.[89] They also contend that the current setup benefits special interests, and potentially disregards the broader ecological values of the area. Others state that there is a lack of transparency in the process of deciding whether or not to act upon recommendations generated by the adaptive management process. In the Adaptive Management Strategy, the description of how senior-level decision-makers decide on changes to CERP or CERP projects based on adaptive management recommendations is unclear.[90] The Strategy does state that the preferred option (i.e., a recommended change) will best represent societal values, scientific input, and reconciliation of policy conflicts.

[88] Alfred R. Light, "Tales of the Tamiami Trail: Implementing Adaptive Management in Everglades Restoration," *Journal of Land Use and Environmental Law*, vol. 22 (Fall 2006), pp. 59-99.

[89] Lance Gunderson and Stephen S. Light, "Adaptive Management and Adaptive Governance in the Everglades Ecosystem," *Policy Science*, vol. 39 (2006), pp. 331-332.

[90] If a change is made, a Comprehensive Plan Modification Report is to be issued.

Figure A-5. Major Ecosystem Restoration Initiatives Utilizing Adaptive Management



Source: Adapted by CRS.

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